DESCRIPTION OF THE MALE OF *VAEJOVIS CHISOS* SISSOM (SCORPIONES, VAEJOVIDAE) FROM TEXAS, U.S.A., WITH COMMENTS ON MORPHOMETRIC AND MERISTIC VARIATION IN THE SPECIES[1]

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ABSTRACT: The scorpion *Vaejovis chisos* Sissom, 1990, is redescribed, based on the collection of three males and a number of new females. The hemispermatophore is described and illustrated, facilitating new comparisons with *Vaejovis sprousei* Sissom, 1990, its closest known relative. Differences in the hemispermatophore and male chela morphometrics clearly separate the two species. Variation in morphometric characters, metasomal setal counts, and pedipalp chela finger dentition is analyzed on the basis of this increased sample size.

KEY WORDS: Scorpiones, Vaejovidae, *Vaejovis chisos*, morphometrics and meristic variation, Texas, U.S.A.

The scorpion V*aejovis chisos* Sissom, 1990, was described on the basis of an adult female and two juvenile specimens from the Chisos Mountains in Big Bend National Park in Texas, U.S.A. The species is closely related to *V. dugesi* Pocock, 1902 and *V. sprousei* Sissom, 1990, neither of which were previously known from adult males. Recently, a significant number of new specimens of *V. chisos* have been collected, including the first adult males, and it is the purpose here to describe the male and provide a better assessment of intraspecific variation in the species. The recent discovery of the male of *V. sprousei* (González Santillán and Sissom, 2004) enables the two species to be more adequately compared.

Measurements were taken using an Olympus Model VMZ dissecting microscope calibrated at 20X, and illustrations were made from the same microscope using an ocular grid. Landmarks for measurements are provided by Sissom et al. (1990). Hemispermatophores were dissected as described by Sissom et al. (1990); terminology for hemispermatophores follows Lamoral (1979) and Stockwell (1989); trichobothrial terminology follows Vachon (1974). GPS data for collecting sites were taken from TrailSmart Topo! GPS Software, Wildflower Productions 1999. Specimens are deposited at Appalachian State University, Boone, North Carolina, U.S.A.

Vaejovis chisos Sissom, 1990

(Figs. 1-4)

Vaejovis chisos Sissom 1990a: 48, 49-51, fig, 2A-G.

Vaejovis chisos: Kovařík, 1998: 146; Sissom and Jackman, 1998: 151; Sissom, 2000: 540; González Santillán et al., 2004: 9.

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Type Data. Holotype female from Kibbee (or Kibbe) Spring, Chisos Basin, Chisos Mountains (1,828 m), Big Bend National Park, Brewster Co., Texas, 31 Aug 1983 (W. D. and J. C. Sissom). Deposited in the American Museum of Natural History, New York, U.S.A.

Distribution. Known only from the Chisos Mountains, Texas, U.S.A.

Description of male. Adult 27.35 mm in length. Base coloration light yellow brown, with moderate fuscosity on dorsum, metasoma, pedipalps, and legs.

Prosoma: Anterior carapacial margin emarginate; median notch weak, rounded; entire carapacial surface finely to coarsely granular.

Mesosoma: Post-tergites densely coarsely granular. Genital operculum completely divided, with genital papillae protruding posteromedially. Pectinal tooth count 17-18. Pectinal teeth large, each with elongate patch of peg sensilla. Sternite VII with one pair of moderate, granular lateral carinae. Stigmata suboval to elongate suboval.

Metasoma: Segments I-IV: Dorsolateral carinae strong, serrate on I-III, crenulate on IV. Lateral supramedian carinae moderate to strong, crenulate. Lateral inframedian carinae on I complete, granulose; on II incomplete, moderate, irregularly granular on posterior third; on III incomplete, weak on posterior third; on IV absent. Ventrolateral carinae moderate, crenulate. Ventral submedian carinae on I weak, smooth to finely granular; on II-IV, moderate, crenulate. Dorsal intercarinal spaces with scattered coarse granulation. Segment V: Dorsolateral carinae moderate, serrate proximally; weak, granular distally. Lateromedian carinae present on anterior three-fourths of segment, moderate, granular. Ventrolateral and ventromedian carinae strong, serrate. Intercarinal spaces finely granular. Metasoma I-IV setal counts: dorsolaterals, 0/0:1/1:1/1:1/1; lateral supramedians, 0/0:1/1:1/1:2/2; lateral inframedians, 1/1:0/0:0/0:0/0; ventrolaterals, 2/2:2/2:2/3:3/3; ventral submedians, 3/3:3/3:3/3:4/4. Ventral accessory setae lacking. Metasomal segment V: dorsolaterals, 3/3; lateromedians, 2/2; ventrolaterals, 4/4. Metasomal segment I length/width = 0.92; III length/width = 1.18; V length/width = 2.38.

Telson: Dorsal surface flattened, smooth; ventral surface with irregular fine granulation and weak punctations, about 16 pairs of large setae.

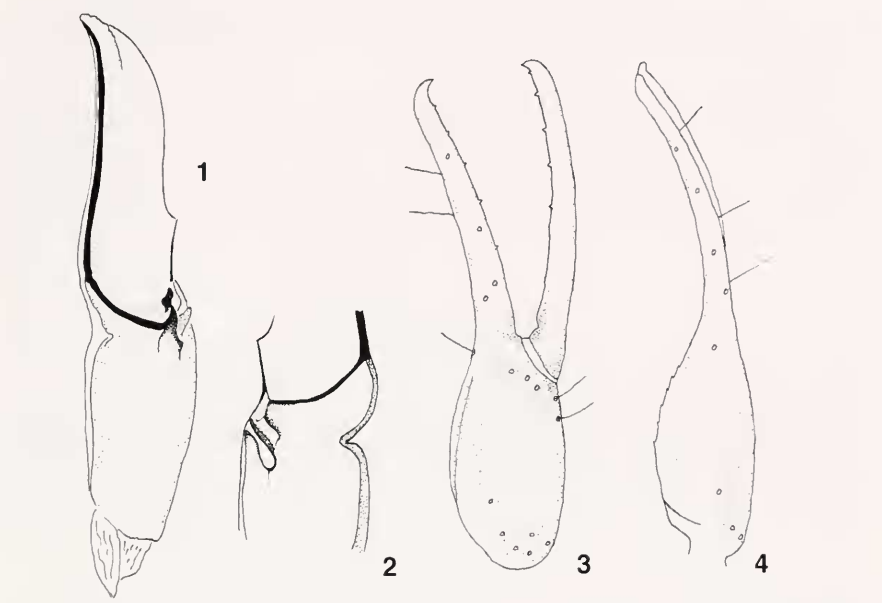
Hemispermatophore (Figs. 1-2): Moderately slender; distal lamina with a distal crest on dorsal surface and a single, blunt hook-like structure near the base. Capsular area with simple invaginated sperm duct floor (Stockwell 1989: 130) and without conspicuous lobes or processes. Sperm duct flanked along distal edge by a series of minute denticle-like structures.

Chelicerae: Dentition typical of family (Vachon 1963; Sissom 1990b, fig. 3.1H); ventral margin of movable finger smooth (i.e., lacking denticles). Ventral aspect of cheliceral movable finger with distinct serrula.

Pedipalps: Trichobothrial pattern Type C, orthobothriotaxic (completely illustrated for the holotype female in Sissom 1990a: Fig. 2, A-F). Femur: Dorsointernal, ventrointernal, and dorsoexternal carinae strong, granulose; ventroexternal carinae vestigial, with irregular coarse granules along distal part of segment. Internal face with about 18-20 large granules; dorsal face with scattered coarse granulation. Femur length/width ratio = 3.47. Patella: Dorsointernal and ventrointernal carinae strong, serrate. Dorsoexternal and ventroexternal carinae moderate, granular. Internal face with longitudinal row of about 16 granules; external face with scattered coarse granulation; dorsal and ventral faces lacking noticeable granulation. Patella length/width ratio = 3.30. Chela (Figs. 3-4) with dorsal marginal carinae weak, granular; dorsointernal carinae weak to moderate, with a few larger, rounded granules; other carinae essentially obsolete. Dentate margin of fixed finger with primary row divided into six subrows by five larger denticles; six inner accessory denticles; trichobothria *ib* and *it* at base of fixed finger. Dentate margin of movable finger with primary denticle row divided into six subrows by five larger denticles; apical subrow with only one denticle; seven inner accessory denticles. Terminal denticles of chela fingers somewhat enlarged and bladelike, overlapping considerably when chela closed; fingertips with small white distal caps. Chela length/width ratio = 4.73; movable finger length/chela width = 3.05; fixed finger length/carapace length = 0.89.

Legs. Midventral spinule row of telotarsus terminating between two pairs of enlarged spinules.

Measurements of male (mm): Total L, 27.35; carapace L, 3.20; mesosoma L, 8.65; metasoma L, 11.95; telson L, 3.55. Metasomal segments: I L/W, 1.65/1.80; II L/W, 1.85/1.70; III L/W, 1.95/1.65; IV L/W, 2.70/1.60; V L/W, 3.80/1.60. Telson: vesicle L/W/D, 2.25/1.30/1.00; aculeus L, 1.30. Pedipalps: femur L/W, 2.95/0.85; patella L/W, 3.30/1.00; chela L/W/D, 5.20/1.10/1.20; fixed finger L, 2.85; movable finger L, 3.35; palm (underhand) L, 2.05.



Figs. 1-4. Morphology of the male of *Vaejovis chisos:* 1, dorsal aspect of right hemispermatophore; 2, ventral aspect of right hemispermatophore; 3, external aspect of right pedipalp chela; 4, dorsal aspect of right pedipalp chela.

Variation. In addition to the three adult males examined, 30 new adult females were also available, providing the opportunity to better analyze variation in morphometric and meristic characters in the species.

Variation in pectinal tooth counts for 3 males and 20 females was as follows: in males, there were 3 combs with 18 teeth and 3 combs with 19 teeth; in females there were 1 comb with 14 teeth, 11 combs with 15 teeth, 22 combs with 16 teeth, and 5 combs with 17 teeth. In the three females from the original type series, there were three combs with 16 teeth and three with 17. In females, the genital opercula have a membranous anterior connection, but in males they are completely separated. Female pectinal teeth are shorter and peglike, in contrast to the larger "banana-shaped" teeth of the male. In addition, each pectinal tooth in the male bears an elongate patch of peg sensilla; these patches are smaller in the female.

Setal counts for the metasoma exhibited little variation. The modal counts, based on the left metasomal I-IV carinae of 20 specimens, were as follows: dorsolaterals, 0:1:1:1; lateral supramedians, 0:1:1:1; lateral inframedians, 1:0:0:0; ventrolaterals, 2:3:3:3; and ventral submedians, 3:3:3:4. In one of the specimens, an unpaired accessory seta was found in the ventral intercarinal space on segment III. For segment V, the modal counts for these specimens were: dorsolaterals, 3; lateromedians, 2; ventrolaterals, 4. Four of the specimens had small setal

pores distally above the ventrolateral carinae (not the larger distal setae on the anal carina where it meets the ventrolateral carina), but these were interpreted as microsetae and not counted.

Variation was also noted in the number of inner accessory denticles flanking the chela finger denticle rows. These were counted on 20 specimens, and the counts are reported for both the left and right sides (L/R). For the chela fixed finger, three specimens exhibited counts of 5/5, five had 5/6 or 6/5, and 12 had 6/6. In most cases (12/16 fingers), those with five granules were missing the basal granule of the series, but on four fingers, the distal denticle was missing. For the movable finger, two specimens had counts of 5/6, one had 7/5, 13 had 6/6, three had 6/7 or 7/6, and one had 7/7. This type of variation in inner accessory denticles is also seen in *Vaejovis vorhiesi* Stahnke, 1940 and related species from Arizona (Sissom, unpub. data).

Variation in selected morphometric ratios of the three adult males is as follows (presented as mean ± sd [range]): chela length/width, 4.78 ± 0.11 (4.71-4.90); pedipalp femur length/width, 3.57 ± 0.14 (3.47-3.73); pedipalp patella length/width, 3.19 ± 0.12 (3.07-3.30); fixed finger length/carapace length, 0.86 ± 0.06 (0.79-0.91); metasomal segment III length/width, 1.23 ± 0.05 (1.18-1.28); metasomal segment V length/width, 2.33 ± 0.05 (2.27-2.38); and carapace length/metasomal segment V length, 0.88 ± 0.62 (0.84-0.91). For 20 females, the ratios were as follows: chela length/width, 4.80 ± 0.25 (4.39-5.25); pedipalp femur length/width, 3.44 ± 0.12 (3.17-3.57); pedipalp patella length/width, 3.08 ± 0.07 (2.96-3.20); fixed finger length/carapace length, 0.86 ± 0.02 (0.81-0.90); metasomal segment III length/width, 1.09 ± 0.03 (1.05-1.13); metasomal segment V length/width, 2.21 ± 0.05 (2.14-2.32); and carapace length/metasomal segment V length, 0.97 ± 0.02 (0.93-1.10).

Comments. The morphometric ratios used earlier to separate females of *V. chisos* from *V. sprousei* (Sissom 1990a) are still largely valid, except that there is very slight overlap between the lower end of the ranges in *V. chisos* and the upper end of the ranges in *V. sprousei*. The differences in the male hemispermatophore (see below) and chela morphometrics (slender in *V. chisos* and slightly inflated in *V. sprousei*) provide additional characters to separate the two species.

Within the *mexicanus* group, the hemispermatophores of *V. chisos* and *V. sprousei* are quite similar in structure. Both have a crest on the distal lamina, a single blunt hook at the base of the blade on the dorsal aspect, and a series of denticles along the invaginated floor of the sperm duct. However, the hemispermatophore of *V. chisos* is much more slender than that of *V. sprousei* (see González Santillán and Sissom, 2004). Further, the denticles along the sperm duct are very distinct in *V. sprousei* but minute and scarcely discernible in *V. chisos*.

Specimens were collected in thickly wooded areas with substantial ground cover (i.e. decayed leaves, plant cover), mainly from the banks and slopes associated with trail cuts. These areas were moister than adjoining slopes where the species was not found.

Specimens Examined. USA: Texas: Brewster Co.: Big Bend National Park, near upper end of Pine Canyon, 27 May 1992 (R. Henson, J. Davidowski, T. Weseman), 3 females, 1 male (ASU); Big Bend National Park, from waterfall in Pine Canyon to edge of wooded area (29°15'44" N: 103°15'15"W to 29°16'01"N: 103°14'44"W), 27 May 1992 (R. Henson, T. Weseman, J. Davidowski), 1 male (ASU); Big Bend National Park, Upper Pine Canyon Trail, 23 May 2003 (R. Henson, P. Carmichael, N. Lopez, A. Anderson), 16 females, 1 male (ASU); 29 May 2003, 1 female, 6 juvs. (ASU); Big Bend National Park, Kibbee Spring Trail (29°16'24"N: 103°17'06"W to 29°16'25"N: 103°17'13"W), 22 May 1992 (R. N. Henson, T. Weseman, J. Davidowski), 1 female (ASU); Big Bend National Park, wooded area of Pine Canyon Trail, 27 May 2002 (R. N. Henson, T. Weseman, J. Davidowski), 9 females, 1 juvenile male (ASU).

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